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(54) Title: MULTI-LAYER IRIDESCENT FILMS

(57) Abstract

A transparent thermoplastic resinous laminate film is disclosed having at least 10 very thin layers of substantially uniform thickness, said layers being generally parallel, the contiguous adjacent layers being of different transparent thermoplastic resinous materials of which one is a naphthalate–based polyester or copolyester resin, the contiguous adjacent layers differing in refractive index by at least about 0.03.

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[Claim 1]

A transparent thermoplastic resinous laminate film of at least 10 very thin layers of substantially uniform thickness, said layers being generally parallel, the contiguous adjacent layers being of different transparent thermoplastic resinous materials of which one is a naphthalate-based polyester or copolyester resin, the contiguous adjacent layers differing in refractive index by at least about 0.03.

[0002]

(Background of the invention)

Iridescent multilayer films are composed of a plurality of generally parallel layers of transparent thermoplastic resinous material. In the multilayer films, the adjacent layers are made of various resinous materials whose index of refraction differs by at least about 0.03. The film contains at least 10 layers and more usually at least 35 layers and, preferably, at least about 70 layers.

[0003]

The individual layers of the film are very thin, usually in the range of about 30 to 500 nm, preferably about 50-400 nm, thereby causing constructive interference in light reflected from the many interfaces. Depending on the layer thickness and the refractive index of the polymers, one dominant wavelength band is reflected, and the remaining light is transmitted through the film. The reflected wavelength is determined by the sum of the optical thickness of a pair of layers.

[0004]

The quantity of the reflected light (reflectance) and the color intensity depend on the difference the two refractive indices, on the ratio of optical thicknesses of the layers, on the number of layers and on the uniformity of the thickness. If the refractive indices are the same, there is no reflection at all from the interfaces between the layers. In iridescent multilayer films, the refractive indices of adjacent layers differ by at least 0.03 and preferably by at least 0.06 or more. For first order reflections, though reflectance is highest when the optical thicknesses of the layers are equal, suitably high reflectances can be achieved when the ratio of the two optical thicknesses falls between 5: 95 and 95: 5. Distinct color reflections can be obtained with as few as 10 layers. However, so as to obtain maximum color intensity, it is preferable to have between 35 and 1000 or more layers. High color intensity is obtained with a reflection band which is relatively narrow and which has high reflectance at its peak. It should be recognized that though the term "color intensity" has been used here for convenience, the same considerations apply for the invisible reflection in the ultraviolet and infrared ranges.